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VOCATIONAL TALENT EXERCISES, PART B.

GEORGE WASHINGTON UNIV., WASHINGTON, D.C.

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THIS WORKBOOK WAS DEVELOPED IN A CURRICULUM PROJECT DESCRIBED IN VT 004 454, TO HELP YOUNG PEOPLE LEARN BASIC PRINCIPLES AND CONCEPTS OF MECHANICS AND TECHNOLOGY BY PROVIDING EXERCISES SIMILAR TO THOSE IN APTITUDE TESTS, EXPLANATIONS OF THE UNDERLYING PRINCIPLES, AND THE CORRECT ANSWERS. IT IS THE SECOND OF FOUR BOOKS WHICH PRESENT 30 EXERCISES WHICH WERE DESIGNED FOR 30 CLASS PERIODS. INFORMATION COVERS ABSTRACT REASONING AND TWO- AND THREE-DIMENSIONAL VISUALIZATION AS IT RELATES TO BASIC MECHANICS AND ELECTRICITY. THE EXERCISES ARE MULTIPLE CHOICE QUESTIONS, LINE DRAWINGS, AND NUMBER SERIES. ANSWERS AND A BRIEF EXPLANATION IN SUPPORT OF THE CORRECT ANSWERS ARE IN THE BACK OF THE BOOK. OTHER RELATED DOCUMENTS ARE VT 004 455 THROUGH VT 004 471. (EM)

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VOCATIONAL TALENT EXERCISES

PART B

THE GEORGE WASHINGTON UNIVERSITY
SCHOOL OF EDUCATION
EDUCATION RESEARCH PROJECT
WASHINGTON, D.C. 20006
1965

VT004459

INTRODUCTION

Several important talents have been found to be very necessary for success in training for good jobs with a future. Your ability in these skills may be measured and used as indicators of your chances of success at different times during your lifetime. Therefore, how well you do in life may depend on how well you master these exercises.

This booklet is the second in this series and continues the abstract reasoning and spatial relations exercises of Part A. In addition, it contains exercises on basic mechanics and electricity. Practice in doing these exercises should increase your ability to succeed in important training programs later on.

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Part A of the Vocational Talent Exercises contained the following exercises:

Exercise	Title
1	Getting the Idea (Abstract Reasoning--Part 1)
2	Seeing Things in Two Dimensions (2-D Visualization--Part 1)
3	Seeing Things in Three Dimensions (3-D Visualization--Part 1)
4	Getting the Idea (Abstract Reasoning--Part 2)
5	Seeing Things in Two Dimensions (2-D Visualization--Part 2)
6	Seeing Things in Three Dimensions (3-D Visualization--Part 2)

Exercise 7

TECHNICAL INFORMATION EXERCISE

Part 1

Here is an exercise on basic information about mechanics, aviation, electricity, and electronics. Choose the correct answer and draw a circle around its letter.

1. Which of these might hold about five quarts of oil?

   A. Lawn mower
   B. Jet airplane
   C. Heavy truck
   D. Passenger car
   E. Oil furnace

2. Tenpenny is a size of

   A. screw.
   B. nail.
   C. nut.
   D. bolt.
   E. tap.

3. A vapor lock will cause an automobile to

   A. stall.
   B. accelerate.
   C. knock.
   D. miss.
   E. overheat.

4. A rheostat can be used to vary

   A. electric current.
   B. gas mixtures.
   C. water pressure.
   D. oil heat.
   E. motor wear.

5. The fan belt often also turns the

   A. wheels.
   B. gears.
   C. starter.
   D. generator.
   E. camshaft.

6. A baseball bat could easily be made with a

   A. chisel.
   B. plane.
   C. lathe.
   D. knife.
   E. axe.

7. AC is a type of

   A. electric current.
   B. bolt design.
   C. airplane engine.
   D. automobile fuel.
   E. wood glue.

8. A distributor is found on

   A. a sewing machine.
   B. a refrigerator.
   C. an automobile.
   D. a lathe.
   E. a radio.

9. A plumb line is often used by

   A. an electrician.
   B. a carpenter.
   C. a mechanic.
   D. a truckdriver.
   E. a riveter.

10. An awl is used to

    A. grind metal.
    B. shape wood.
    C. punch holes.
    D. drive nails.
    E. cut paper.

11. Airplane flaps are found on the

    A. tail.
    B. wings.
    C. radio.
    D. generator.
    E. instrument panel.

12. Many radio tubes have a

    A. commutator.
    B. magneto.
    C. condenser.
    D. plate.
    E. transformer.

13. In flying an airplane, the ailerons are used to

A. bank the wings.
B. slow down on landing.
C. stop the landing roll.
D. dive the plane.
E. make it climb.

14. Gears of different sizes are found in the automobile

A. generator.
B. brake drums.
C. manifold.
D. transmission.
E. universal joint.

15. Gauges are used to

A. set screws.
B. pull nails.
C. hammer metal.
D. cut threads.
E. measure.

16. Static electricity can be caused by

A. pressure.
B. friction.
C. cold.
D. lubrication.
E. none of these.

17. The fuel tanks in a large commercial airplane are usually in the

A. tail.
B. cockpit.
C. engines.
D. fuselage.
E. none of these.

18. Epoxy is a kind of

A. wax.
B. lubricant.
C. glue.
D. fuel.
E. tool.

19. A common voltage for house wiring systems is

A. 25.
B. 50.
C. 150.
D. 300.
E. none of these.

20. A monkey wrench is always

A. small.
B. expensive.
C. adjustable.
D. heavy.
E. flexible.

21. Which of these is not a wrench?

A. Open-end
B. Socket
C. Box-end
D. Torque
E. Ball peen

22. A screw with a four-way slot is usually called

A. offset.
B. jack.
C. dovetail.
D. mill.
E. Phillips-type.

23. A crowbar is designed for

A. punching holes.
B. setting screws.
C. prying.
D. drilling.
E. cutting.

24. A diaphragm will often be found in a

A. fuel pump.
B. tire.
C. brake.
D. transmission.
E. fuel gauge.

Answers are given in the back of the booklet.

Exercise 8

GETTING THE IDEA

(Abstract Reasoning--Part 3)

Most of the problems in this exercise are the same type as the problems you solved in Part A. All the rules and principles of abstract reasoning you have learned so far will be used. Please go back to Exercise 4 in Part A and review it.

You must be very careful in doing this exercise. Study the problem and determine what rule or principle you have to follow to get the correct answer. There will be some problems which will use a new principle. Take your time and study the problem carefully.

As you do this exercise, ask yourself these questions:

1. Does the problem use the principle of direction? If so, which direction?
2. Are the figures increasing or decreasing in size?
3. Does the problem combine the principles of direction and size?

If the problem you are working on does not fit any of these questions, then try to figure out the new rule or principle.

Remember, the answer to each abstract reasoning problem completes a pattern. Just like a jigsaw puzzle, the answer which goes in the box with the question mark will fit because it is the right size and shape and is in the correct position.

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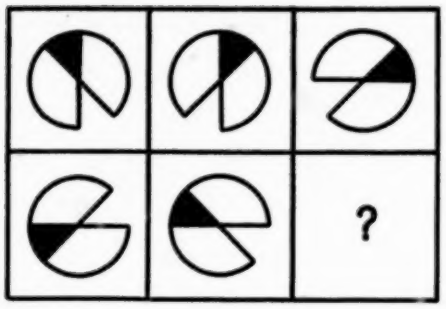

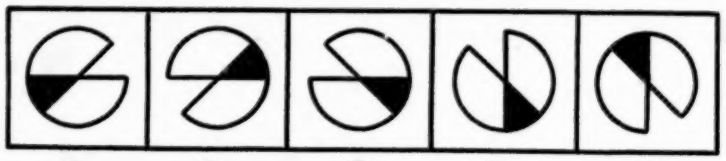

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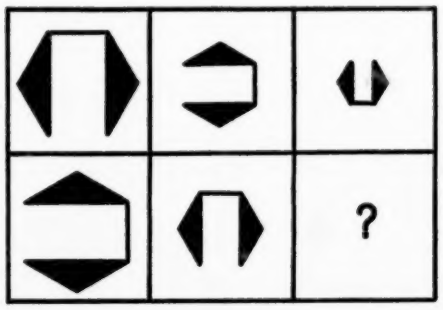

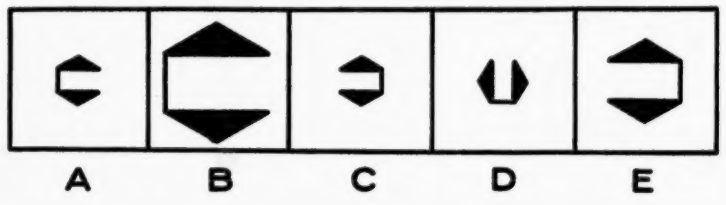

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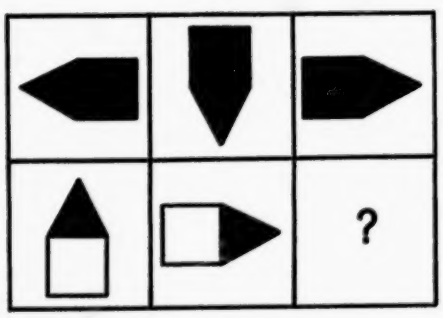

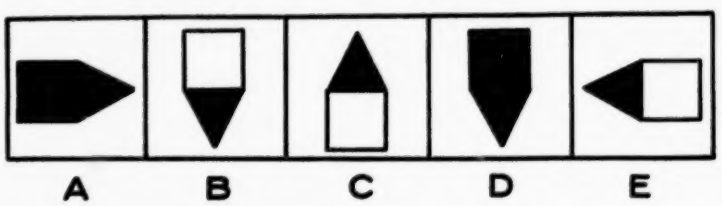

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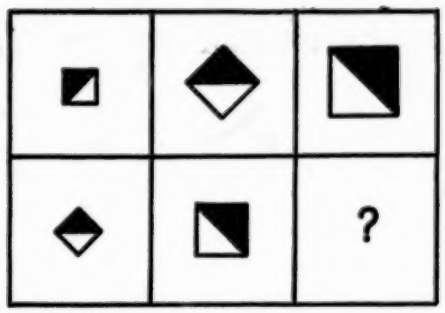

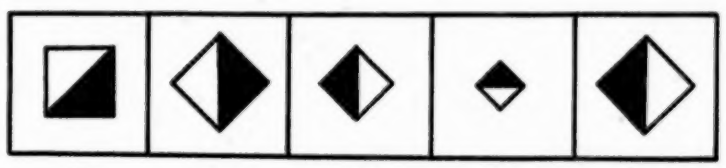

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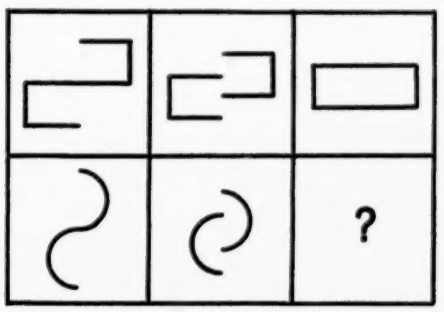

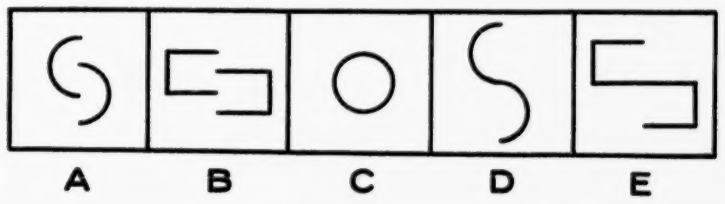

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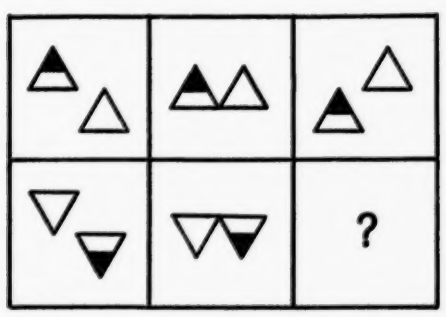

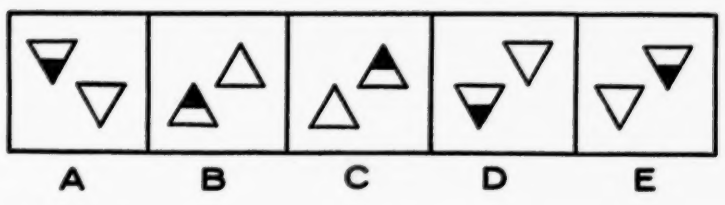

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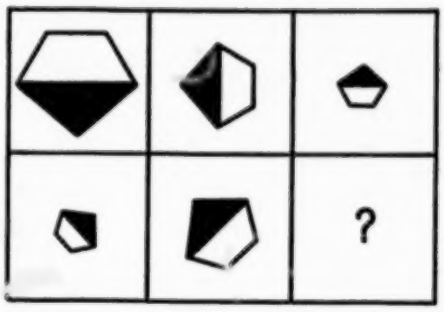

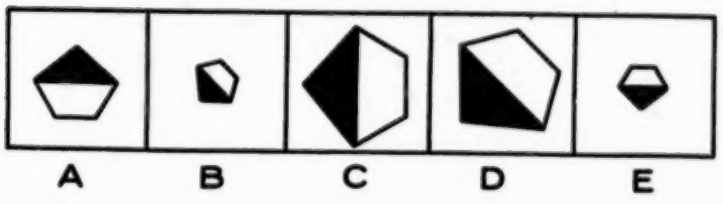

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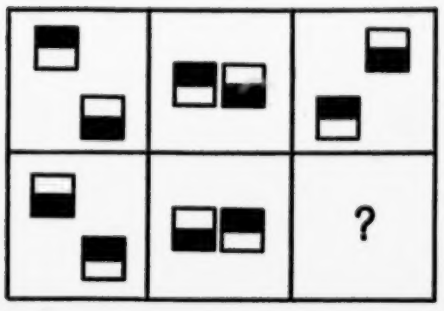

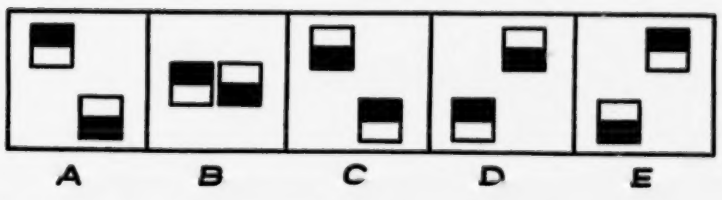

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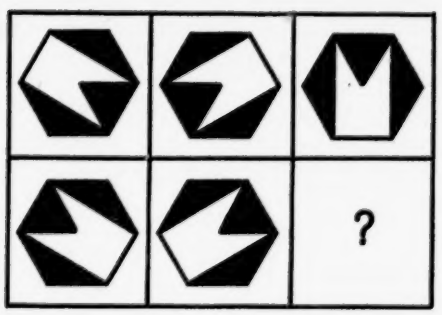

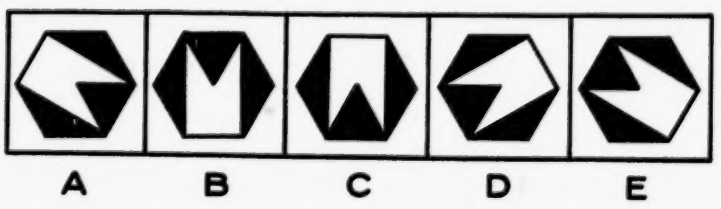

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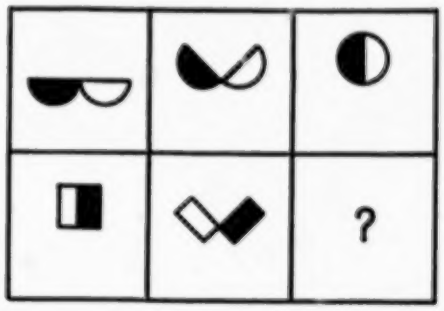

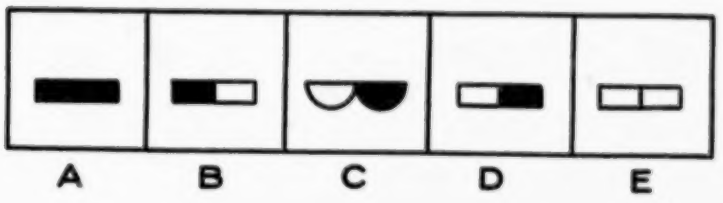

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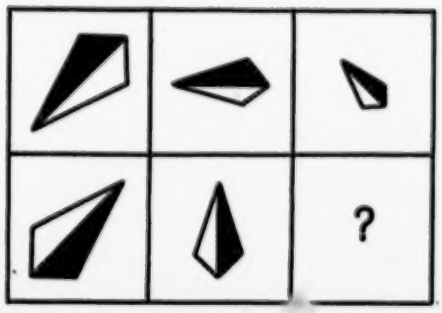

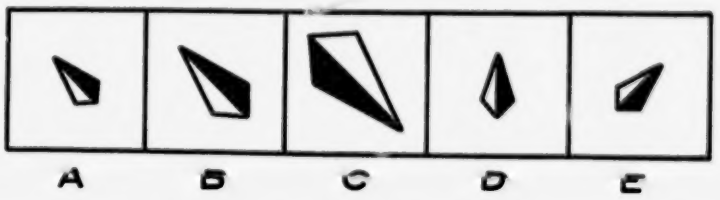

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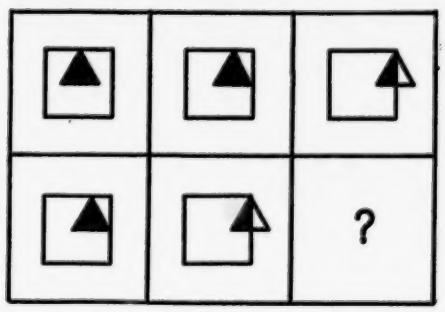

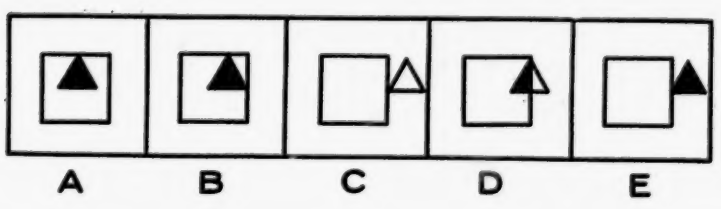

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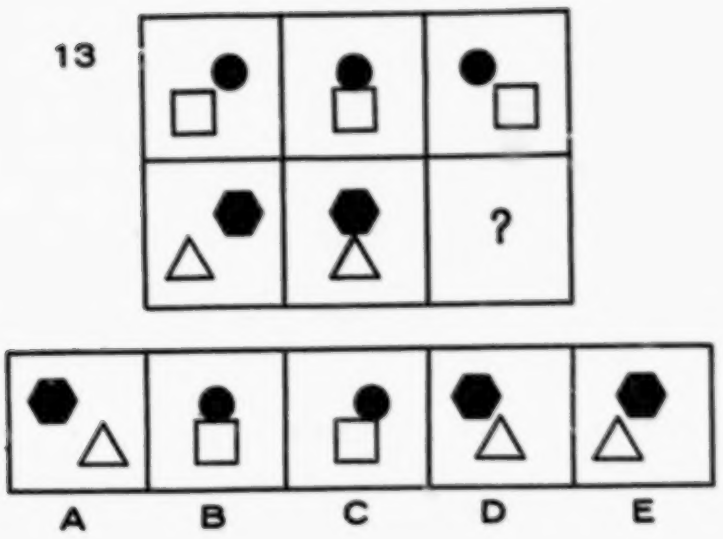

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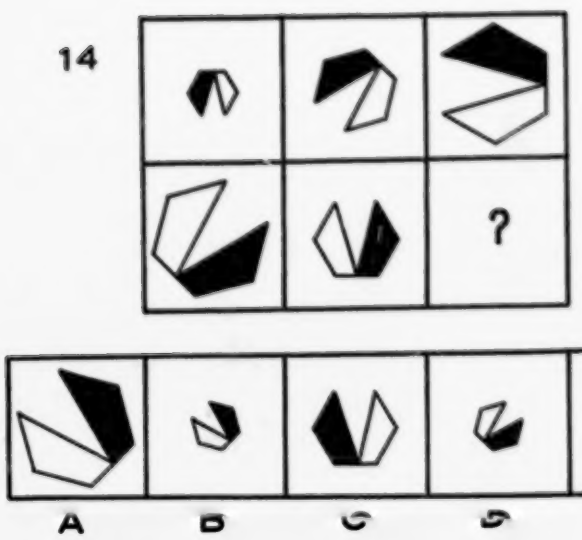

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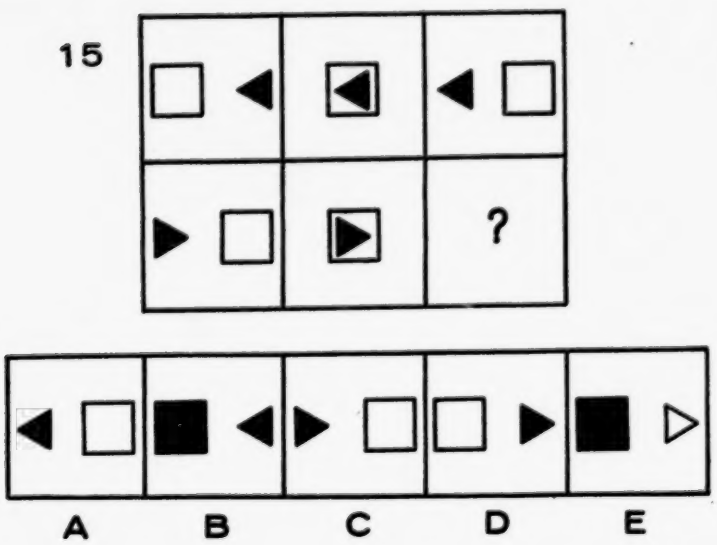

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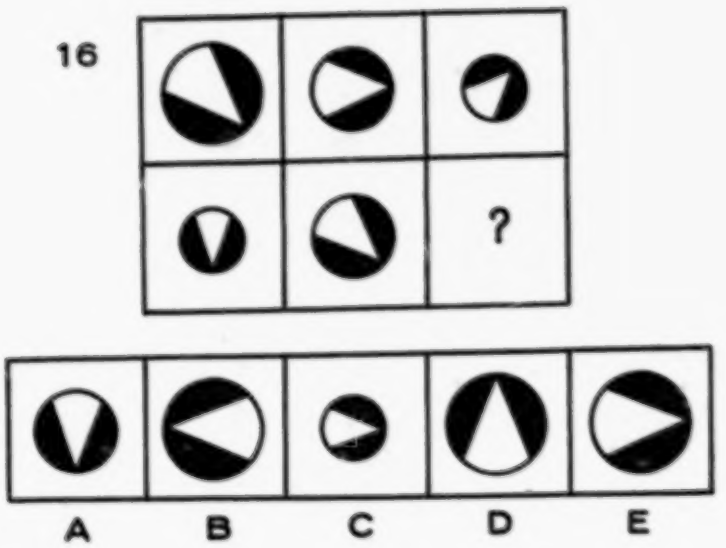

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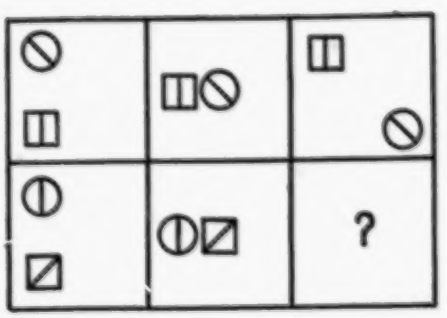

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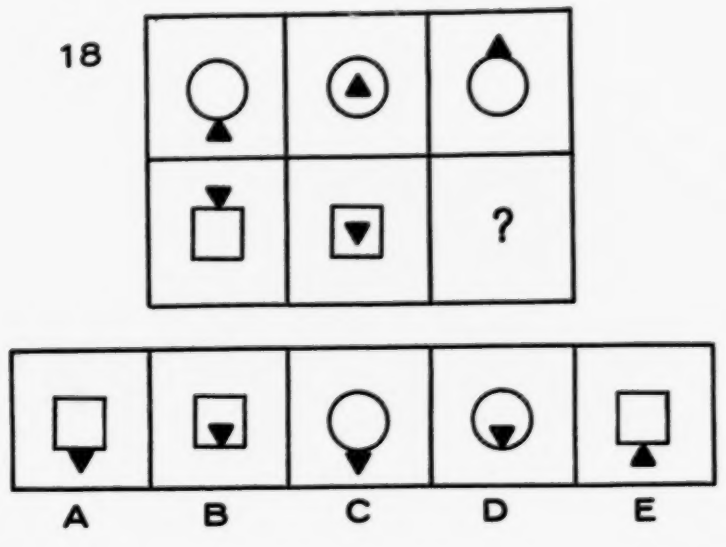

Answers are given in the back of the booklet.

Exercise 9

SEEING THINGS IN TWO DIMENSIONS

(2-D Visualization--Part 3)

Here are three more drills to give you practice in seeing things in two dimensions.

Before you start on these drills, please refresh your memory on what you should do by looking back at Exercises 2 and 5 in Part A of these Vocational Talent Exercises.

When you have finished your review, go on to the drills that follow.

Remember that there is only one correct answer. It must look like the drawing in the box to the left of the five boxes.

Circle the correct answer for each item. When you have finished with each drill, check your answers in the back of the booklet.

Drill 1

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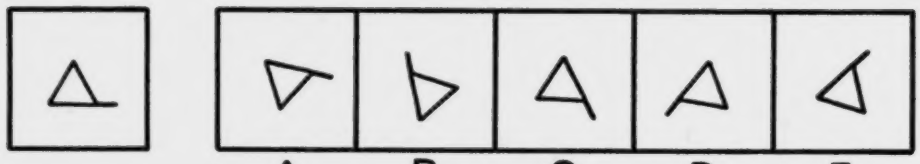

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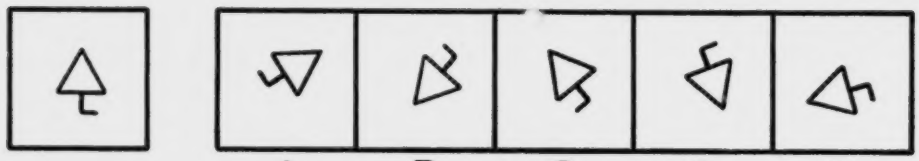

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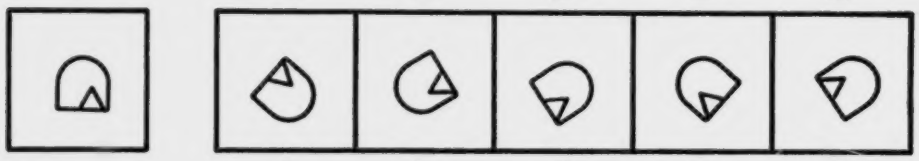

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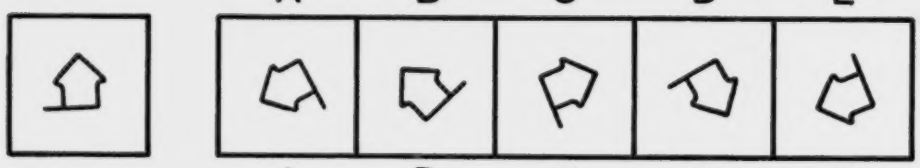

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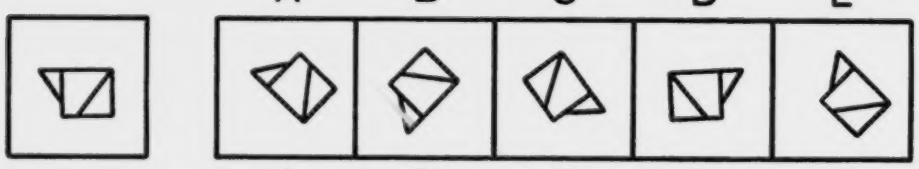

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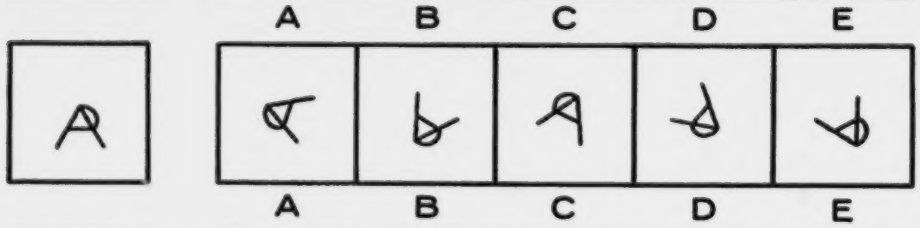

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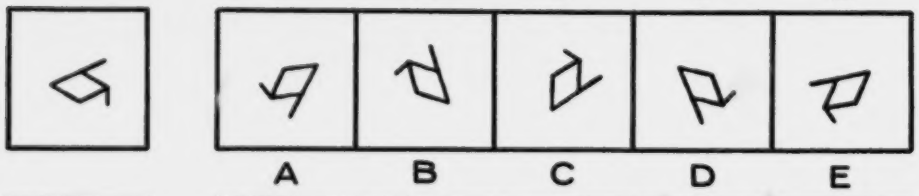

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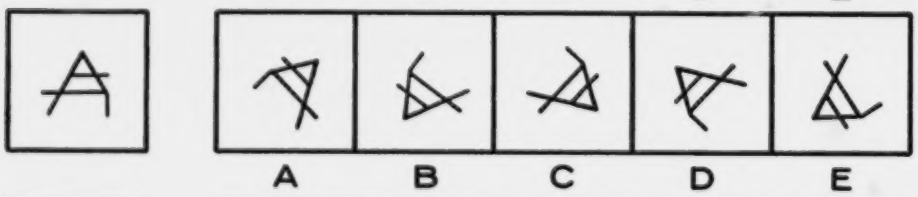

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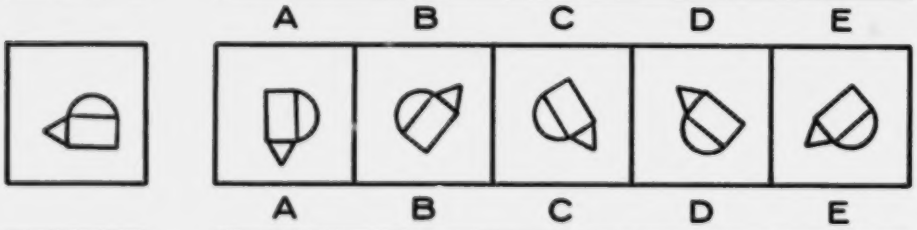

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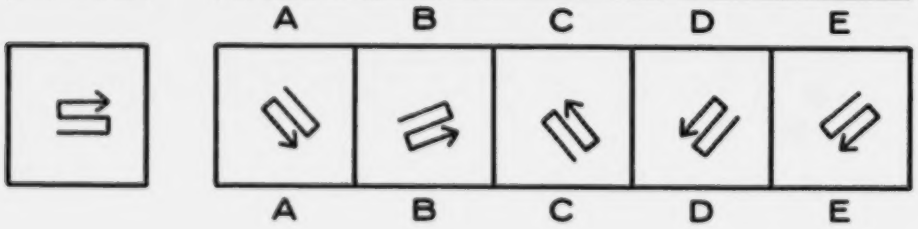
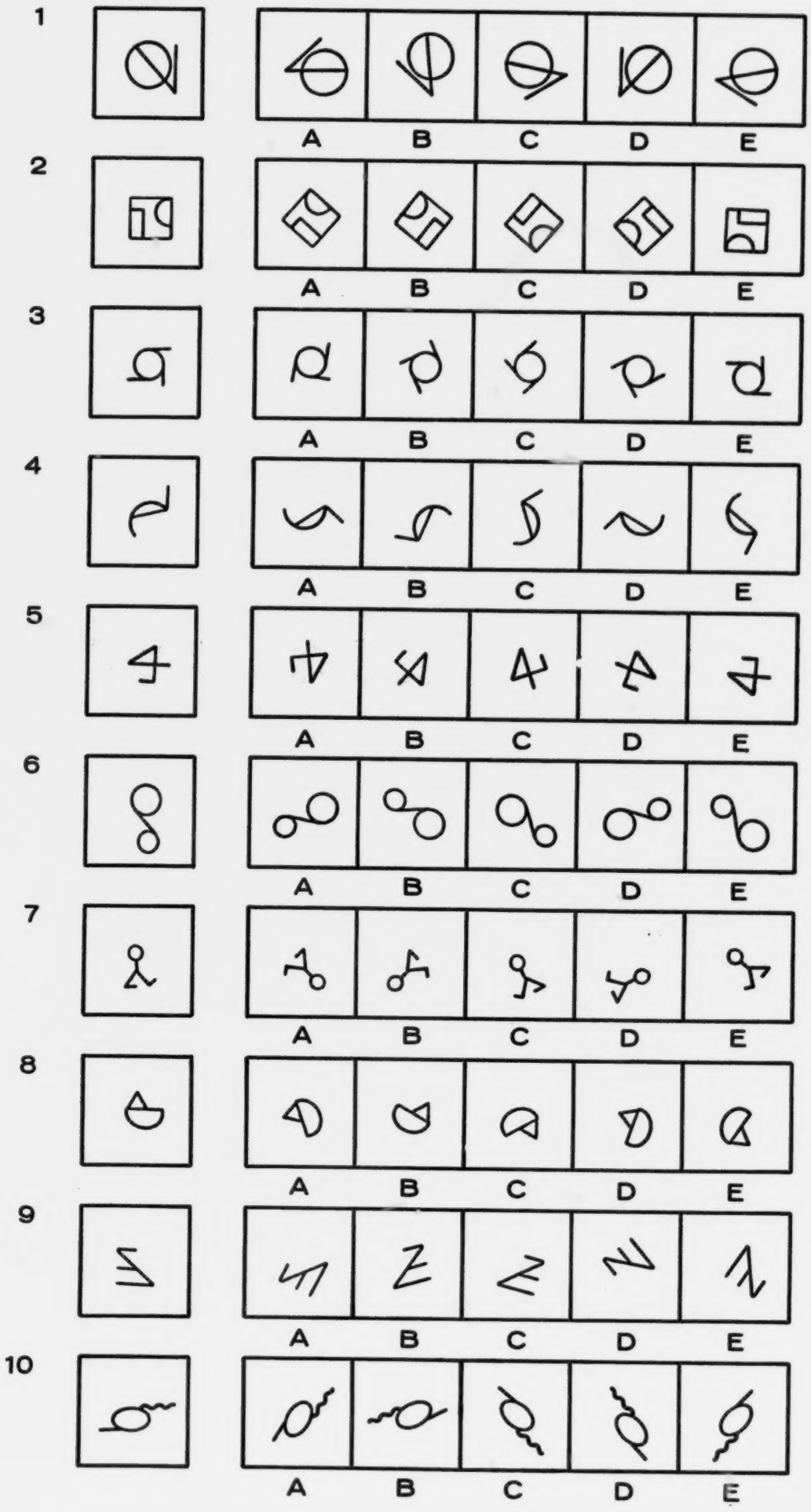


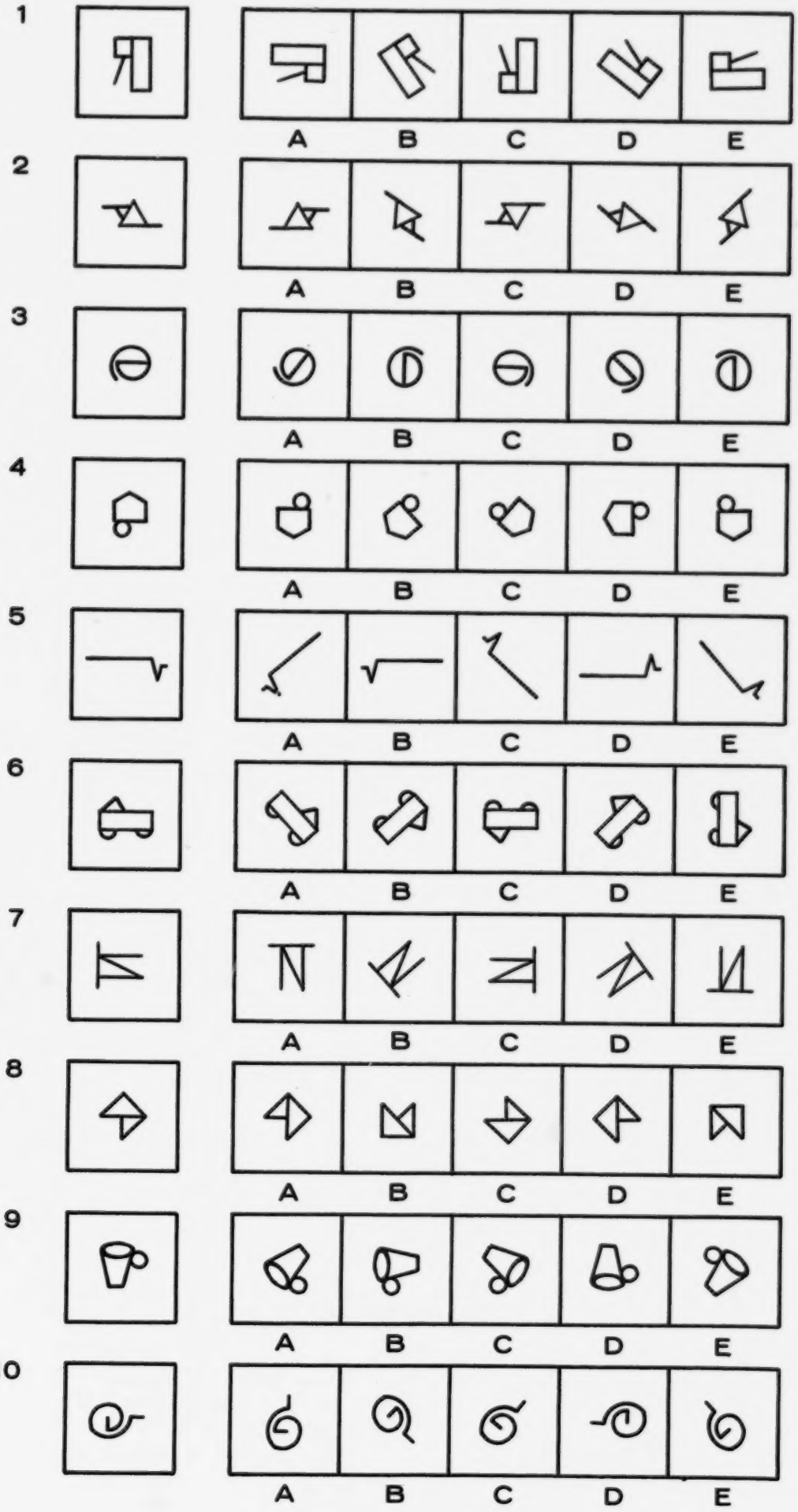
Answers are given in the back of the booklet.

Drill 2



Answers are given in the back of the booklet.

Drill 3



Answers are given in the back of the booklet.

Exercise 10

TECHNICAL INFORMATION EXERCISE

Part 2

Here is an exercise on basic information about mechanics, aviation, electricity, and electronics. Choose the correct answer and draw a circle around its letter.

1. Oil is used to
   - A. reduce friction.
   - B. lessen movement.
   - C. clean dirt.
   - D. eliminate weight.
   - E. none of these.

2. Welding is often done with
   - A. ethyl gas.
   - B. acetylene gas.
   - C. methane.
   - D. gasoline.
   - E. kerosene.

3. An overheated engine can develop a frozen
   - A. wheel.
   - B. radiator.
   - C. brake.
   - D. cam.
   - E. piston.

4. "D" cells can be found in
   - A. automobiles.
   - B. trucks.
   - C. washing machines.
   - D. flashlights.
   - E. generators.

5. A blown head gasket will reduce pressure in the
   - A. radiator.
   - B. brake lining.
   - C. battery.
   - D. gas line.
   - E. cylinders.

6. Ball peen is a kind of
   - A. saw.
   - B. hammer.
   - C. drill.
   - D. battery.
   - E. radio.

7. A ground is often found in
   - A. a brake system.
   - B. a hydraulic lift.
   - C. a clutch.
   - D. an electric circuit.
   - E. a hand pump.

8. An amplifier is found in
   - A. a television set.
   - B. a lathe.
   - C. a battery.
   - D. an air conditioner.
   - E. a dishwasher.

9. Magnets have
   - A. poles.
   - B. cylinders.
   - C. plates.
   - D. cams.
   - E. grids.

10. Phillips is a kind of
    - A. nail.
    - B. rivet.
    - C. nut.
    - D. screw.
    - E. bolt.

11. A manifold is found on
    - A. an automobile engine.
    - B. a radio.
    - C. a television set.
    - D. a washing machine.
    - E. a can opener.

12. The current flow from a battery is measured in
    - A. farads.
    - B. henrys.
    - C. volts.
    - D. watts.
    - E. amperes.

13. A circuit breaker often does the work of a

A. commutator.
B. coil.
C. voltmeter.
D. condenser.
E. fuse.

14. Hydraulic fluid is often used in an automobile

A. differential.
B. brake system.
C. battery.
D. radiator.
E. rear end.

15. DC stands for

A. drill compress.
B. disc cutter.
C. direct current.
D. dry cell.
E. none of these.

16. Number 2 fuel oil can be used by

A. an ordinary automobile.
B. a diesel engine.
C. a lawn mower.
D. a power saw.
E. none of these.

17. The voltage of a five-cell flashlight will usually be about

A. 3.
B. 5.
C. $7\frac{1}{2}$.
D. $12\frac{1}{2}$.
E. 15.

18. Which of these can be used as a lubricant?

A. Castor oil
B. Petroleum
C. Whale oil
D. Graphite
E. All of the above

19. Tungsten carbide is used in the manufacture of

A. gas.
B. plastic.
C. tools.
D. fuels.
E. none of these.

20. An alloy is usually made of

A. steel.
B. copper.
C. salt.
D. two or more metals.
E. none of these.

21. A ripsaw would be used to cut

A. steel.
B. wood.
C. paper.
D. brass.
E. plastic.

22. Hydramatic is a common type of

A. brake.
B. differential.
C. engine.
D. tire.
E. transmission.

23. A starter motor will usually have

A. a valve seat.
B. an armature.
C. a vacuum gauge.
D. a rocker arm.
E. an expander ring.

24. Batteries have

A. inductors.
B. capacitors.
C. terminals.
D. resistors.
E. relays.

Answers are given in the back of the booklet.

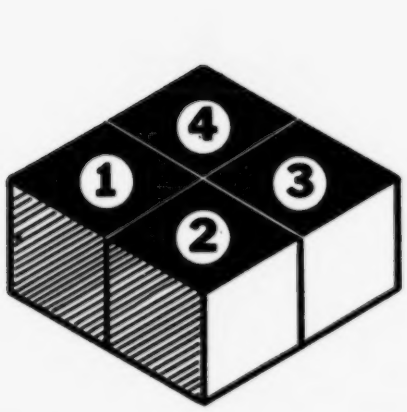
Exercise 11

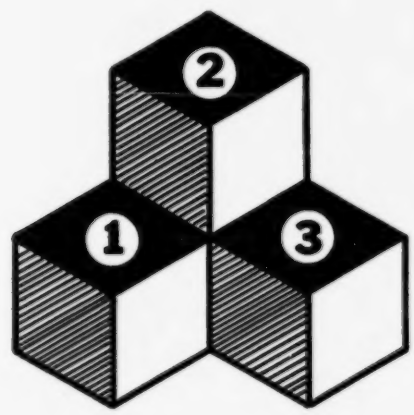
SEEING THINGS IN THREE DIMENSIONS

(Block Counting--Part 1)

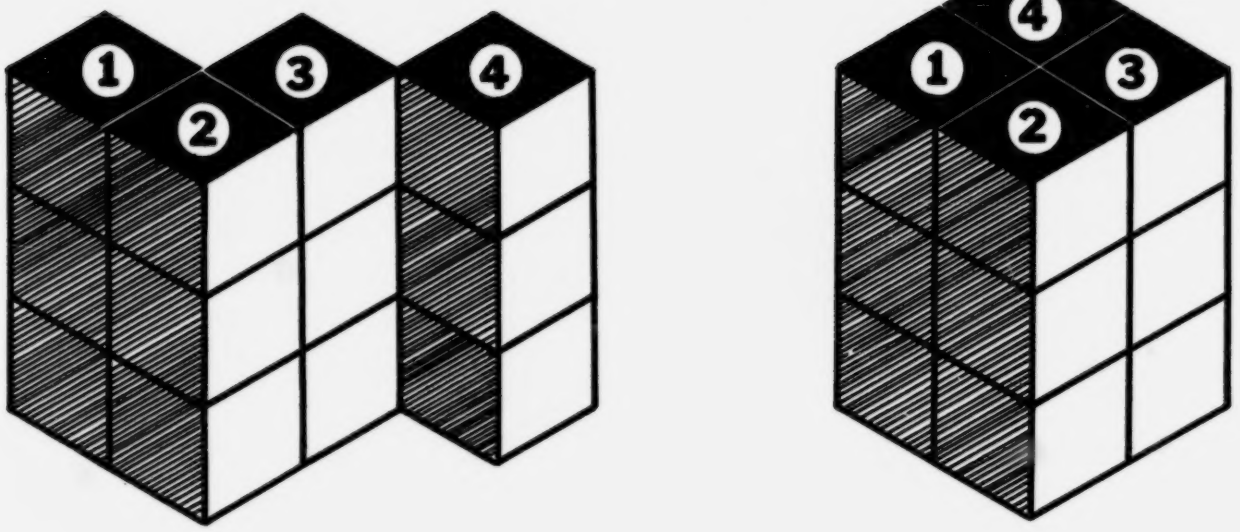
Another important method of reasoning is found in block counting. The purpose of this exercise is to show how to count all the blocks in a drawing even though some of the blocks will not be visible.

Look at the two drawings below:





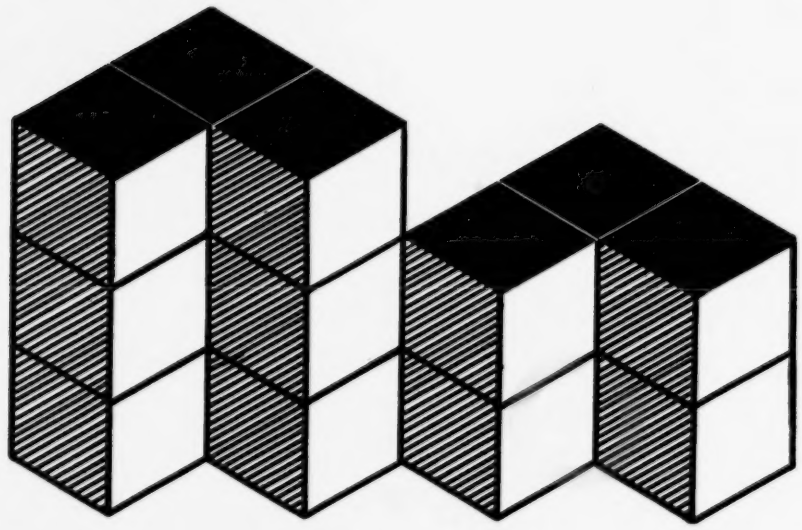
The drawing on the left shows four blocks. They are all visible. In the drawing on the right you can see only three blocks, but you know there are really four. The figure on the right can be made by putting the No. 2 block on top of the No. 4 block.



The drawing on the left in the above example shows four stacks with three blocks in each stack. This means that there are twelve blocks in the drawing.

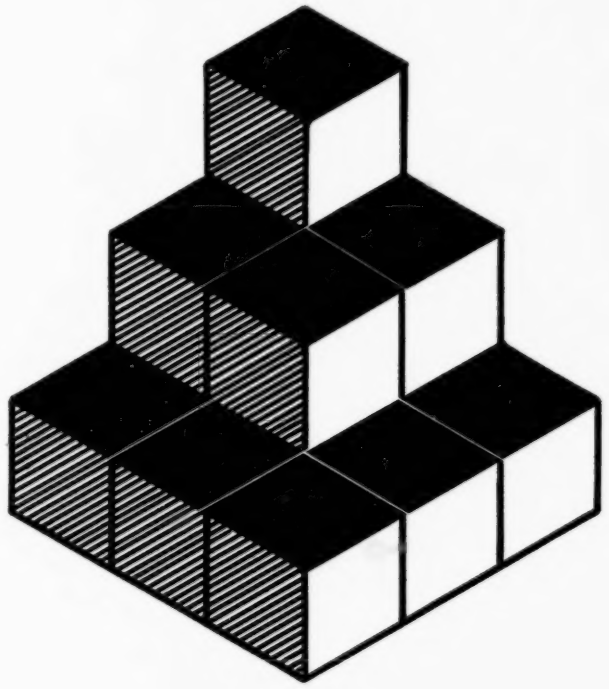
Look at the drawing on the right. It is the same as the left one except that the No. 4 stack has been moved to the rear of stack No. 2. Although you cannot see the two bottom blocks in stack No. 4, you know they are there and should be counted. In other words, in the drawing to the right, parts of ten blocks are in sight. The other two to make up the total of twelve are out of sight in stack No. 4.

How many blocks were used to make this next drawing:



There are three stacks with three layers of blocks and three stacks with two layers. This makes nine blocks on the left and six blocks on the right. Therefore, the total number of blocks is fifteen.

Another way to count the number of blocks can be illustrated with the drawing to the right:



Instead of counting the number of blocks in each stack, count how many are in each layer. The bottom layer has nine blocks, the second layer has four blocks, and the top layer has one block. When added all together there is a total of fourteen blocks.

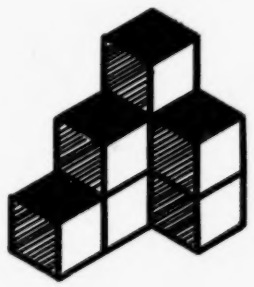
When you count these same blocks by stacks, you find that the tallest stack has three blocks. There are three stacks with two blocks each, which makes six more. There are also five single blocks. When you add all these together, you get the total number of blocks in the drawing, which is fourteen.

Use whichever way is easier for you. You can check your answers by using both methods.

Look at the piles of blocks in the drill that follows and write the correct number of blocks in the space under each pile. All the blocks in each drawing are the same size and shape. If there is more than one layer of blocks, each block in the second layer will be on top of another block. The top block of each stack is visible.

DRILL 1

1



2

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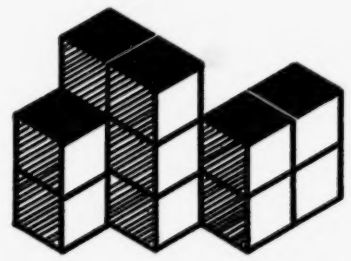

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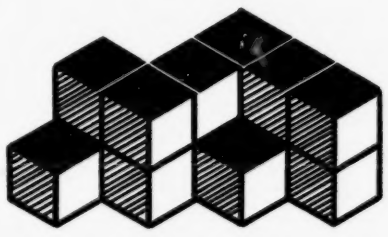

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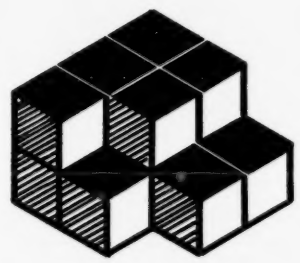

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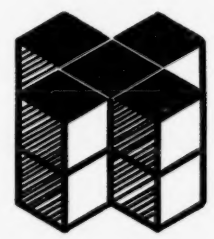

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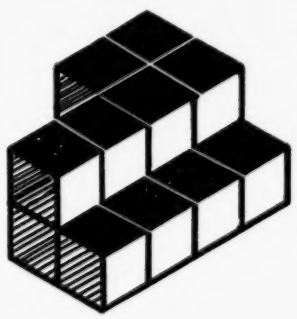

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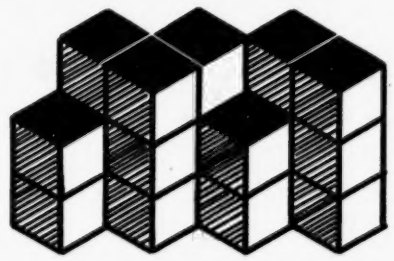

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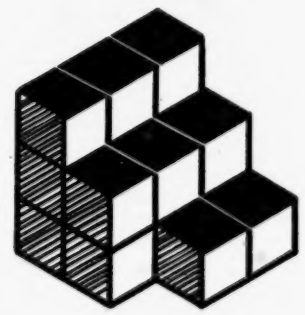

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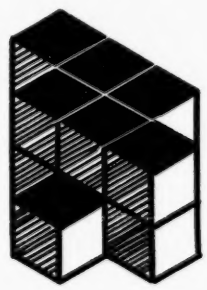

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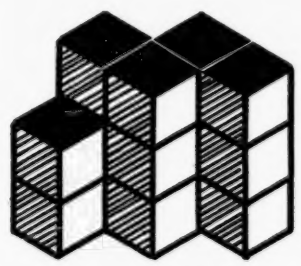

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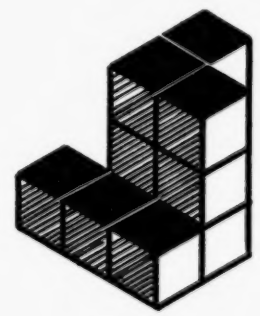

Answers are given in the back of the booklet.

DRILL 2

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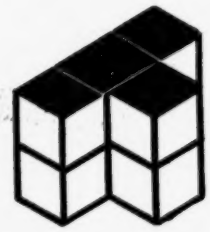

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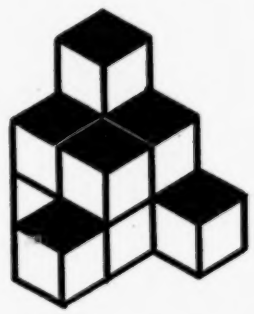

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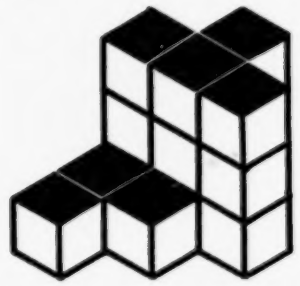

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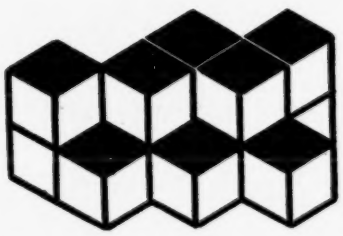

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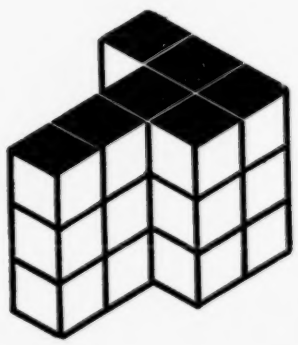

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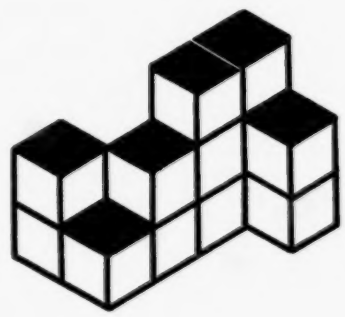

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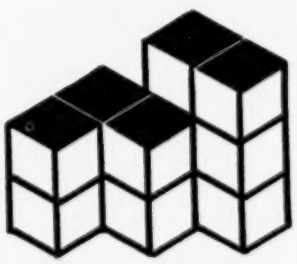

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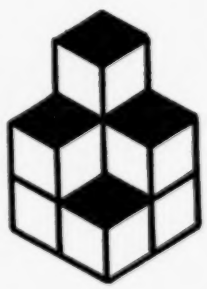

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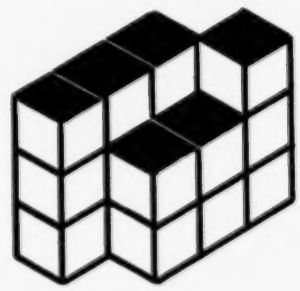

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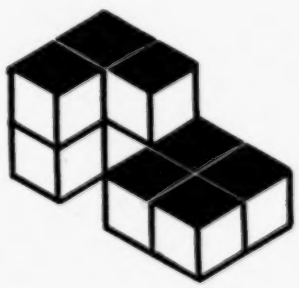

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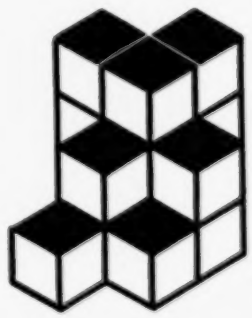

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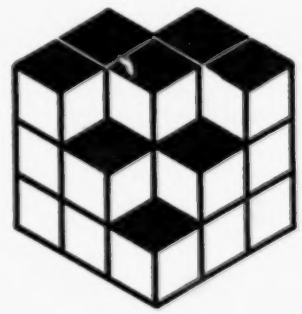

Answers are given in the back of the booklet.

DRILL 3

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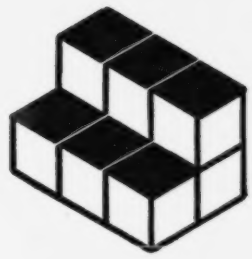

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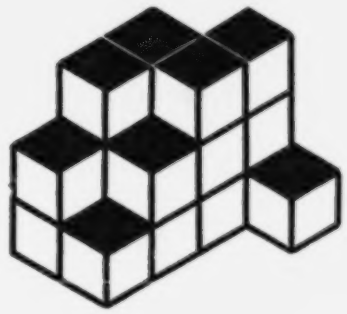

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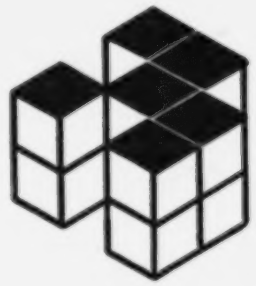

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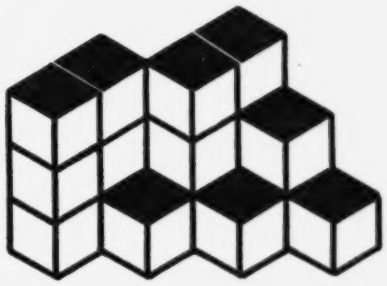

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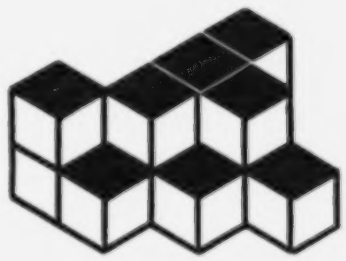

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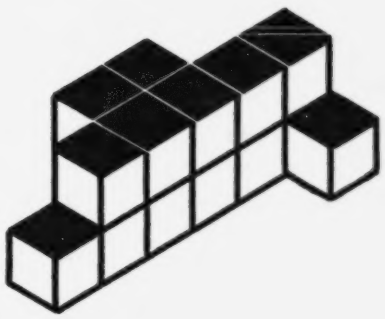

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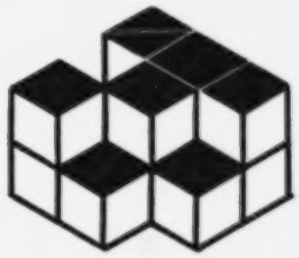

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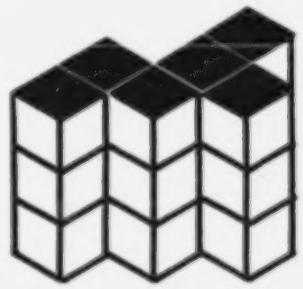

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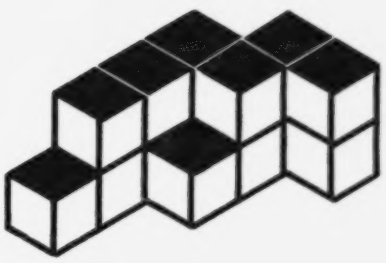

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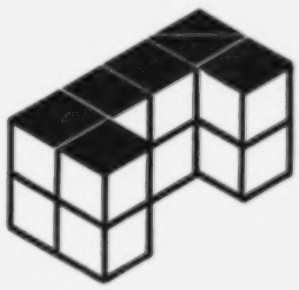

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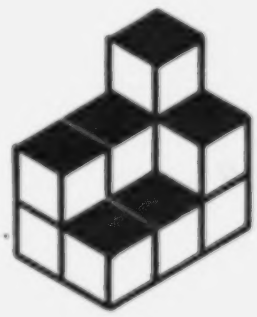


Answers are given in the back of the booklet.

Exercise 12

TECHNICAL INFORMATION EXERCISE

Part 3

Here is an exercise on basic information about mechanics, aviation, electricity, and electronics. Choose the correct answer and draw a circle around its letter.

1. Material can be held steady by clamping in a
   - A. vise.
   - B. trowel.
   - C. T-square.
   - D. set screw.
   - E. gauge.

2. A block and tackle is used for
   - A. lifting.
   - B. drilling.
   - C. cutting.
   - D. polishing.
   - E. none of these.

3. Brakes often
   - A. stall.
   - B. vanish.
   - C. slide.
   - D. knock.
   - E. fade.

4. A voltmeter measures
   - A. temperature.
   - B. electricity.
   - C. stress.
   - D. distance.
   - E. hardness.

5. An electric light bulb contains a
   - A. filament.
   - B. battery.
   - C. fuse.
   - D. coil.
   - E. condenser.

6. A cold chisel would be used to
   - A. join metal.
   - B. set screws.
   - C. polish wood.
   - D. cut metal.
   - E. weld.

7. Compressed gas will be found in
   - A. a refrigerator.
   - B. a generator.
   - C. an electric motor.
   - D. an amplifier.
   - E. a hydraulic brake.

8. A fulcrum is used with a
   - A. knife.
   - B. hammer.
   - C. lever.
   - D. compressor.
   - E. electric motor.

9. A cam will be found in
   - A. a voltmeter.
   - B. an awl.
   - C. an automobile engine.
   - D. a rheostat.
   - E. a generator.

10. Ailerons are found on
    - A. trucks.
    - B. lathes.
    - C. pumps.
    - D. lawn mowers.
    - E. airplanes.

11. An automobile engine block contains the
    - A. cylinders.
    - B. brake drums.
    - C. carburetor.
    - D. distributor.
    - E. voltage regulator.

12. Jig is a type of
    - A. hammer.
    - B. drill.
    - C. anvil.
    - D. saw.
    - E. chisel.

13. A transformer may be used to change

A. capacitance.
B. voltage.
C. resistance.
D. hydraulic pressure.
E. radiation.

14. Calipers are used for

A. measuring.
B. drilling.
C. cutting.
D. grinding.
E. polishing.

15. Which kind of hammer is used to pull nails?

A. Sledge
B. Claw hammer
C. Mallet
D. Brass hammer
E. Ball peen hammer

16. Bolts have

A. points.
B. hinges.
C. threads.
D. handles.
E. none of these.

17. Joints are often sealed with a

A. lubricant.
B. wax.
C. liquid.
D. gasket.
E. none of these.

18. Paint brushes are often cleaned with

A. lubricants.
B. solvents.
C. petroleum.
D. oxidizers.
E. none of these.

19. Holes can be drilled with a

A. brace and bit.
B. chisel.
C. plane.
D. awl.
E. punch.

20. Caulking compound is used for

A. greasing machines.
B. gluing wood.
C. oiling tools.
D. drilling holes.
E. filling cracks.

21. Taps are usually used with

A. files.
B. dies.
C. chisels.
D. micrometers.
E. drills.

22. The flywheel on an automobile engine will usually be located at the rear of the

A. connecting rod.
B. drive shaft.
C. camshaft.
D. crankshaft.
E. rocker arm.

23. A commutator will be found on

A. an oscilloscope.
B. a battery.
C. a generator.
D. a clutch.
E. a carburetor.

24. Which of these will have magnets?

A. Telephone
B. Microphone
C. Loud speaker
D. Generator
E. All of these

Answers are given in the back of the booklet.

Exercise 13

GETTING THE IDEA
(Abstract Reasoning--Part 4)

In Exercise 1 you found the relationships between figures that were turning clockwise or counterclockwise. In Exercise 4 you found relationships between figures that were getting larger or smaller as well as turning.

Now we will show you how to find relationships between a series of numbers. For instance, what is the relationship between the numbers in this series?

1, 2, 3, 4, 5, and so on

Each number is one larger than the number to its left. If they grow bigger two at a time, then the series would look like this:

1, 3, 5, 7, 9, and so on

It is a simple matter in a series such as this to figure out what the next number would be. In the first example, the next number would be 6. In the second example, it would be 11.

Sometimes the numbers will get smaller, like this:

8, 7, 6, 5, 4, ____

The answer is 3.

There are many ways to make a series. Sometimes the number is double the one to its left, like this:

1, 2, 4, 8, 16, ____

The answer is 32.

Sometimes the series is made by adding an increasing number each time. In the example below, first one is added, then two, then three, and so on:

1, 2, 4, 7, 11, ____

The next number is 16.

Now try to figure out the answers to the problems in Drill 1. What you do is to figure out how the numbers in the series are increasing or decreasing and what the next number would be when you continue in the same way. Write the next number in the blank to the right.

Drill 1

Fill in the next number of the series in the space to the right.

1) 2, 3, 4, 5, 6, ____

2) 2, 4, 6, 8, 10, ____

3) 3, 5, 7, 9, 11, ____

4) 10, 9, 8, 7, 6, ____

5) 12, 10, 8, 6, 4, ____

6) 22, 23, 24, 25, 26, ____

7) 63, 62, 61, 60, 59, ____

8) 24, 26, 28, 30, 32, ____

9) 3, 6, 9, 12, 15, ____

10) 24, 21, 18, 15, 12, ____

11) 5, 10, 15, 20, 25, ____

12) 13, 18, 23, 28, 33, ____

13) 65, 60, 55, 50, 45, ____

14) 27, 22, 17, 12, 7, ____

15) 20, 23, 26, 29, 32, ____

16) 57, 53, 49, 45, 41, ____

17) 15, 19, 23, 27, 31, ____

18) 67, 70, 73, 76, 79, ____

19) 38, 42, 46, 50, 54, ____

20) 43, 41, 39, 37, 35, ____

21) 76, 71, 66, 61, 56, ____

22) 1, 3, 5, 7, 9, ____

23) 79, 83, 87, 91, 95, ____

24) 70, 75, 80, 85, 90, ____

25) 97, 96, 95, 94, 93, ____

26) 52, 47, 42, 37, 32, ____

27) 25, 21, 17, 13, 9, ____

28) 61, 64, 67, 70, 73, ____

29) 44, 49, 54, 59, 64, ____

30) 63, 60, 57, 54, 51, ____

31) 57, 53, 49, 45, 41, ____

32) 56, 53, 50, 47, 44, ____

Turn to page 39 to check your answers.

Drill 2

Fill in the next number of the series in the space to the right.

1) 1, 2, 4, 7, 11, ____

2) 15, 16, 18, 21, 25, ____

3) 24, 23, 21, 18, 14, ____

4) 37, 36, 34, 31, 27, ____

5) 1, 3, 6, 10, 15, ____

6) 56, 58, 61, 65, 70, ____

7) 35, 33, 30, 26, 21, ____

8) 48, 46, 43, 39, 34, ____

9) 2, 4, 8, 14, 22, ____

10) 15, 17, 21, 27, 35, ____

11) 24, 26, 30, 36, 44, ____

12) 66, 64, 60, 54, 46, ____

13) 79, 77, 73, 67, 59, ____

14) 95, 93, 89, 83, 75, ____

15) 3, 6, 12, 21, 33, ____

16) 5, 8, 14, 23, 35, ____

17) 1, 2, 4, 8, 16, ____

18) 64, 32, 16, 8, 4, ____

19) 3, 4, 6, 10, 18, ____

20) 65, 33, 17, 9, 5, ____

21) 5, 6, 8, 12, 20, ____

22) 7, 9, 13, 21, 37, ____

23) 66, 34, 18, 10, 6, ____

24) 34, 18, 10, 6, 4, ____

25) 69, 71, 75, 81, 89, ____

26) 4, 6, 9, 13, 18, ____

27) 58, 55, 49, 40, 28, ____

28) 48, 42, 35, 27, 18, ____

29) 77, 71, 63, 53, 41, ____

30) 84, 83, 80, 75, 68, ____

31) 65, 67, 71, 77, 85, ____

32) 97, 94, 90, 85, 79, ____

Turn to page 39 to check your answers.

Exercise 14

SEEING THINGS IN THREE DIMENSIONS

(Block Counting--Part 2)

This is another exercise to give you practice in visualizing things in three dimensions.

Please go back over the instructions given in Exercise 11 and work some of the problems again.

When you count the blocks, you should remember the following rules:

(1) All the blocks in each drawing are the same size and shape

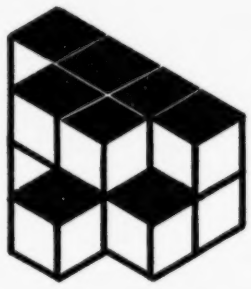
(2) The top block in each stack is visible

(3) If there is more than one layer, the stack goes all the way down to the bottom.

Now go on to the next page.

DRILL 1

1



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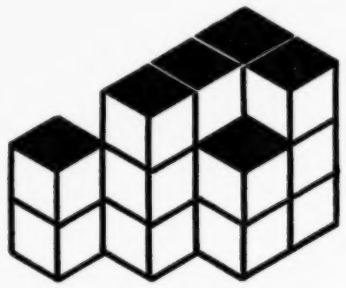

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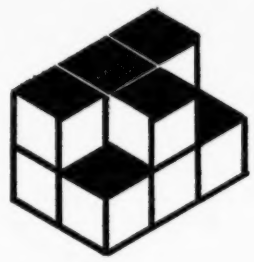

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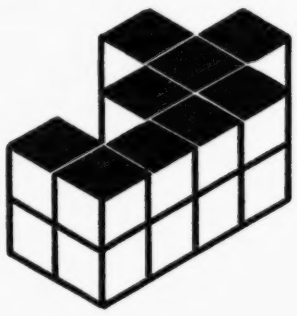

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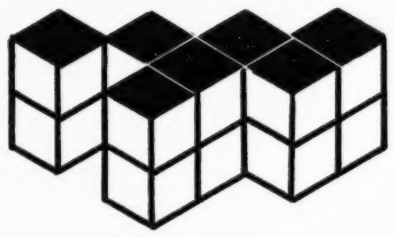

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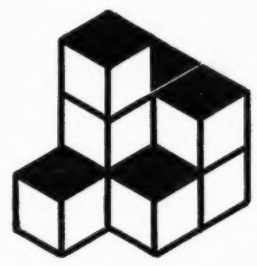

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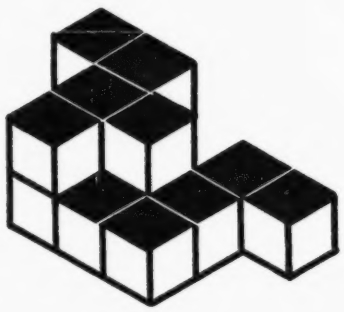

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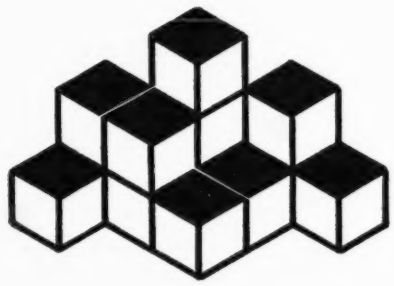

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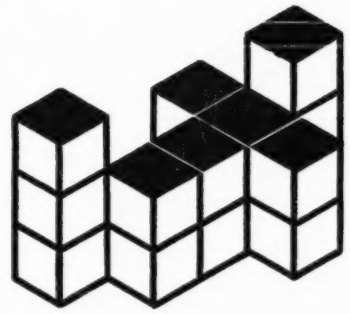

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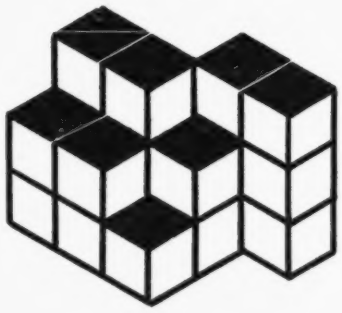

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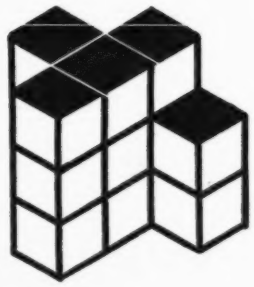

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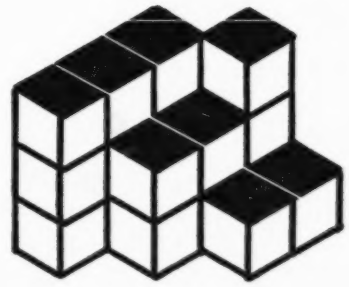

Answers are given in the back of the booklet.

DRILL 2

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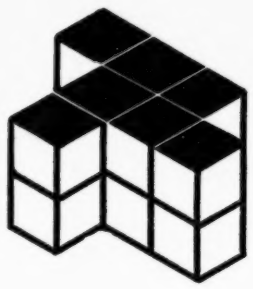

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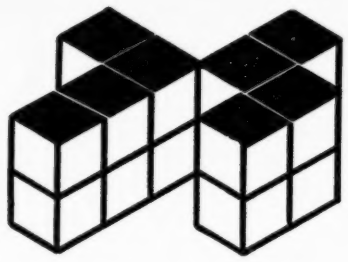

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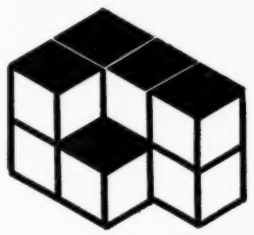

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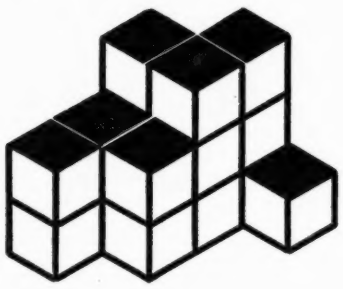

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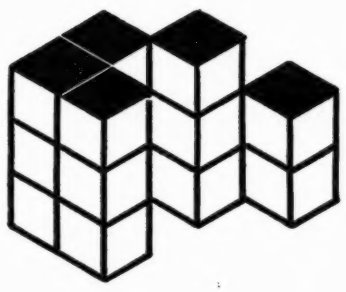

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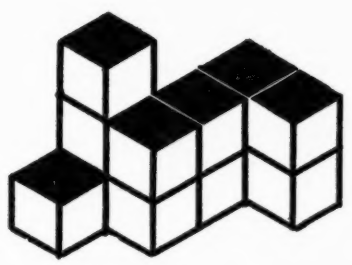

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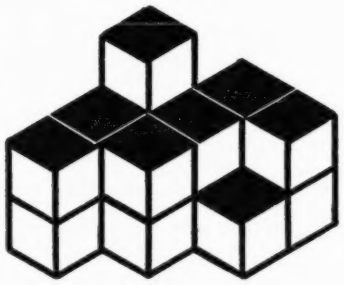

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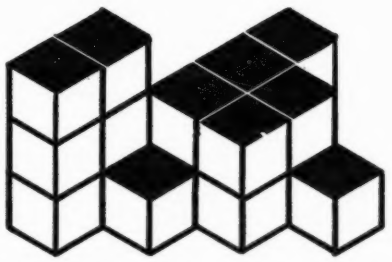

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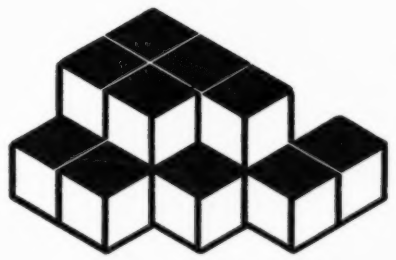

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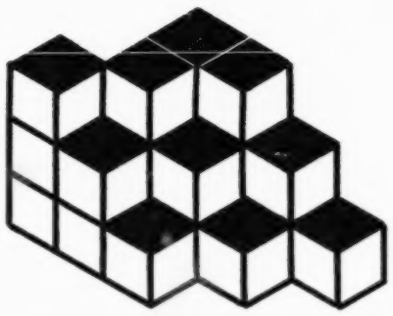

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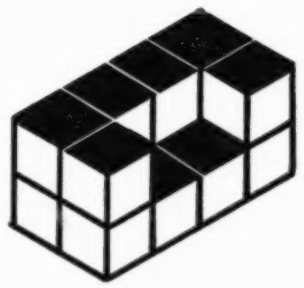

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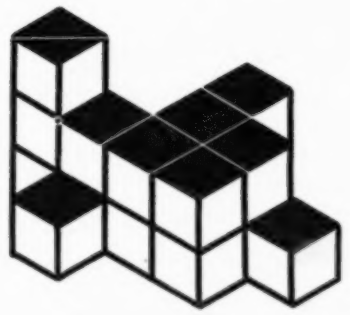

Answers are given in the back of the booklet.

DRILL 3

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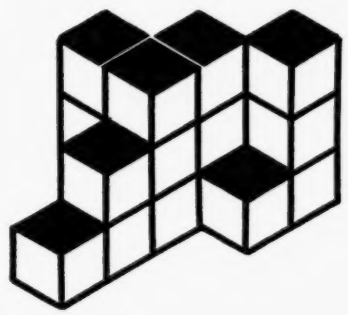

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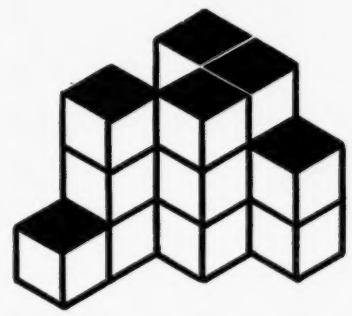

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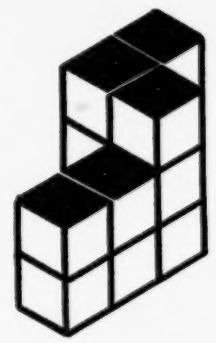

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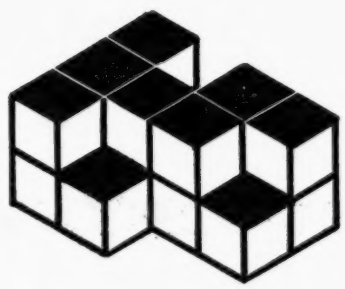

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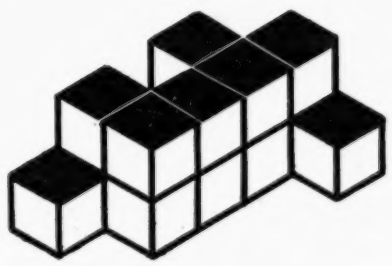

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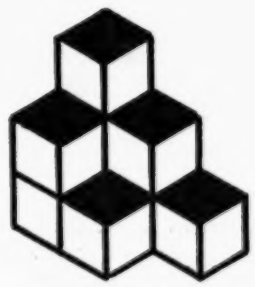

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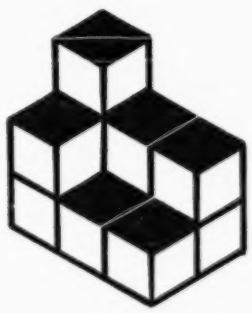

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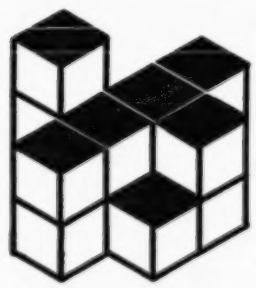

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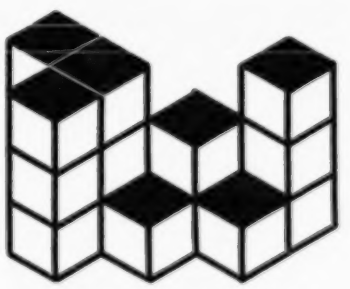

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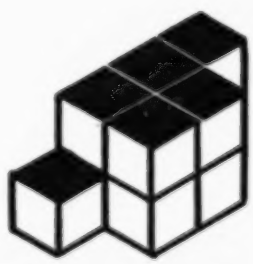

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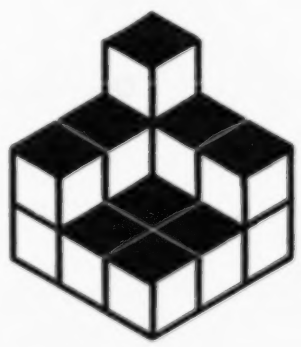

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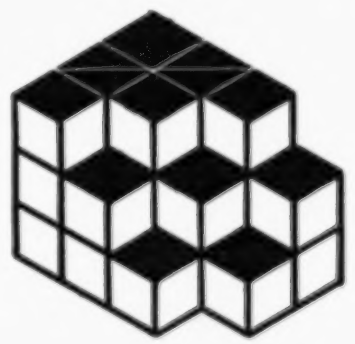

Answers are given in the back of the booklet.

Exercise 15

TECHNICAL INFORMATION EXERCISE

Part 4

Here is an exercise on basic information about mechanics, aviation, electricity, and electronics. Choose the correct answer and draw a circle around its letter.

1. Rivets are usually made of
   - A. metal.
   - B. wood.
   - C. clay.
   - D. paper.
   - E. plastic.

2. Open-end is a type of
   - A. nail.
   - B. screw.
   - C. wrench.
   - D. hammer.
   - E. saw.

3. Electric circuits are often kept from overloading by use of
   - A. coils.
   - B. rheostats.
   - C. fuses.
   - D. capacitors.
   - E. magnetoes.

4. A flooding carburetor is using too much
   - A. air.
   - B. gasoline.
   - C. heat.
   - D. pressure.
   - E. water.

5. Neon is often used in
   - A. welding.
   - B. light fixtures.
   - C. lubrication.
   - D. engines.
   - E. soldering.

6. A carpenter's plane is used to smooth
   - A. plastic.
   - B. paper.
   - C. metal.
   - D. wood.
   - E. cloth.

7. In an automobile, electricity is obtained from the
   - A. distributor.
   - B. generator.
   - C. relay.
   - D. spark plugs.
   - E. rheostat.

8. A block and tackle always has
   - A. cams.
   - B. gears.
   - C. springs.
   - D. pulleys.
   - E. locks.

9. A vise is used to
   - A. polish wood.
   - B. hold material.
   - C. set screws.
   - D. pull nails.
   - E. drill holes.

10. Ratchet is a kind of
    - A. wrench.
    - B. hammer.
    - C. drill.
    - D. motor.
    - E. brake.

11. A transistor works somewhat like a
    - A. battery.
    - B. capacitor.
    - C. coil.
    - D. generator.
    - E. tube.

12. A hacksaw is designed for cutting
    - A. leather.
    - B. paper.
    - C. stone.
    - D. metal.
    - E. wood.

13. Acid is found in an automobile

A. transmission.
B. differential.
C. battery.
D. voltage regulator.
E. none of these.

14. Protractors measure

A. heat.
B. angles.
C. pressure.
D. distance.
E. hardness.

15. A spark caused by a short circuit will generate

A. heat.
B. radio waves.
C. television waves.
D. static.
E. all of these.

16. Leverage is exerted by

A. a wrench.
B. an anvil.
C. a fuse.
D. a ball peen hammer.
E. none of these.

17. Dovetail is a type of

A. joint.
B. wrench.
C. hammer.
D. screwdriver.
E. vise.

18. Which of these are hydraulic devices?

A. Condensers
B. Transistors
C. Rectifiers
D. Vacuum tubes
E. None of these

19. Water power can produce electricity by means of a

A. motor.
B. battery.
C. amplifier.
D. grid.
E. generator.

20. A Geiger counter is used to

A. count compounds.
B. measure speed.
C. detect radiation.
D. measure distance.
E. measure electricity.

21. An auger is used to

A. smooth wood.
B. cut paper.
C. turn a bolt.
D. drill holes.
E. measure something.

22. Soldering is used to

A. polish metal.
B. decorate.
C. join pieces of metal.
D. clean wood.
E. remove wax.

23. Burned gases escape from an engine through the

A. carburetor.
B. gasket.
C. manifold.
D. piston.
E. throttle.

24. A bolt is usually used with a

A. flange.
B. spline.
C. bevel.
D. nail.
E. nut.

Answers are given in the back of the booklet.

ANSWERS

Exercise 7

Item No.	Answer	Explanation
1	D	Most passenger car engines hold between four and six quarts of oil in their lubricating system.
2	B	Nail sizes are measured in "pennies." Originally the number of pennies was the price for a hundred. Now pennies indicate size.
3	A	When a vapor lock forms in the gasoline supply line of an automobile, no gasoline can get by it to the carburetor. This causes the car to stall for lack of fuel.
4	A	A rheostat is a variable electrical resistance. When the setting of the rheostat is changed the amount of current in the circuit is raised or lowered.
5	D	The primary purpose of the fan belt is to drive the fan which draws air through the radiator of the car. In many cars it turns the generator or alternator also.
6	C	Anything round, like a baseball bat, is probably made on a wood lathe. The lathe turns the wood round and round at high speed. A cutter is held against the spinning wood until it is the proper shape.
7	A	AC is a type of electric current. It stands for alternating current.
8	C	The automobile distributor is part of its ignition system. It controls the firing of the spark plugs in proper time with the pistons.
9	B	A carpenter would use a plumb line to square up a wall.
10	C	An awl is for punching holes. It is like a heavy straight needle with a handle.
11	B	Airplane flaps are on the wings to help reduce speed on landing.
12	D	The plate or anode is the principal electrode to which the electron stream is attracted in a radio tube.

Item No.	Answer	Explanation
13	A	Ailerons are control flaps on the wings of airplanes used for tipping or banking the plane right or left when turning in the air.
14	D	The transmission is the name for the complicated set of gears used in an automobile for changing the speed and direction of power flow.
15	E	There are many kinds of gauges. They are all used to measure something.
16	B	Static electricity can be caused by friction. In winter you can generate static enough to get a slight shock when you shuffle across a rug.
17	E	Fuel tanks in large commercial airplanes are usually in the wings, so none of the answers is correct.
18	C	Epoxy is a type of glue using two liquids which will not act alone, but when combined form a very strong adhesive.
19	E	In the United States the usual house current voltage is 110 volts.
20	C	A monkey wrench can be large or small, cheap or expensive, heavy or light, or fixed or flexible, but it is always adjustable.
21	E	There is no ball peen wrench. but there is a ball peen hammer. Its head is flat on one side and round on the other.
22	E	A Phillips-type screw requires a special Phillips-type screwdriver which will match the four-way slot in the screw head.
23	C	A crowbar is a long steel rod which has a flattened end used for prying.
24	A	There are many kinds of fuel pumps. The most common variety has a diaphragm as part of the pump.

Exercise 8

ANSWERS

Item No.	Answer	Explanation
1	E	The figures in both rows turn the same amount and direction.
2	A	The figures in both rows get smaller and turn the same amount and direction.
3	B	The second row turns in the opposite direction from the first row.
4	B	Both rows increase in size and turn the same amount and direction.
5	C	Here is a problem with a new principle. The first row shows two halves of a box coming together. The second row shows halves of a circle coming together.
6	E	All the triangles on the left of each box move downward, and all the triangles on the right of each box move upward.
7	D	The first row decreases in size and turns clockwise. The second row increases in size and turns counterclockwise.
8	E	In both rows the figures in each box move downward on the left and upward on the right. Notice which half of the figures in the second row is darkened.
9	C	The figures in both rows are turning the same amount clockwise.
10	D	In the top row, two halves of a circle come together. The figure in the second row is like a box being split in half.
11	A	The figures in both rows are decreasing in size. The second row is turning opposite to the first row but turning the same amount.
12	C	In this problem the square does not move. The triangle moves from left to right in both rows, and moves from behind the square.
13	A	The triangle in the second row moves like the square in the first row. The hexagon in the second row moves like the circle.
14	B	The figures in the first row increase in size and turn clockwise. In the second row they decrease in size and turn counterclockwise.
15	D	Notice the relative motion of the two figures.
16	E	The first row is decreasing, counterclockwise; the second row is increasing, counterclockwise.
17	B	This one is a little tricky. In the first row the circle moves from top left to bottom right, while the square moves straight up. In the second row the square moves from bottom left to top right and the circle moves straight down.
18	A	In the first row the triangle moves up over the circle. In the second row the triangle moves down over the square.

ANSWERS

Exercise 9

Drill 1	Drill 2	Drill 3
1. D	1. E	1. D
2. B	2. A	2. B
3. C	3. C	3. E
4. A	4. D	4. A
5. E	5. B	5. C
6. D	6. B	6. B
7. A	7. A	7. E
8. B	8. C	8. D
9. C	9. A	9. C
10. E	10. E	10. D

Exercise 10

See answers on pages 40 and 41

Exercise 11

Drill 1	Drill 2	Drill 3
1. 8	1. 8	1. 9
2. 11	2. 11	2. 18
3. 12	3. 15	3. 12
4. 14	4. 13	4. 17
5. 13	5. 21	5. 14
6. 10	6. 13	6. 13
7. 16	7. 12	7. 16
8. 19	8. 8	8. 12
9. 17	9. 16	9. 18
10. 13	10. 10	10. 14
11. 14	11. 15	11. 12
12. 12	12. 20	12. 11

Exercise 12

See answers on pages 42 and 43

Exercise 13

Drill 1

1. 7	12. 38	23. 99
2. 12	13. 40	24. 95
3. 13	14. 2	25. 92
4. 5	15. 35	26. 27
5. 2	16. 37	27. 5
6. 27	17. 35	28. 76
7. 58	18. 82	29. 69
8. 34	19. 58	30. 48
9. 18	20. 33	31. 37
10. 9	21. 51	32. 41
11. 30	22. 11	

Drill 2

1. 16	12. 36	23. 4
2. 30	13. 49	24. 3
3. 9	14. 65	25. 99
4. 22	15. 48	26. 24
5. 21	16. 50	27. 13
6. 76	17. 32	28. 8
7. 15	18. 2	29. 27
8. 28	19. 34	30. 59
9. 32	20. 3	31. 95
10. 45	21. 36	32. 72
11. 54	22. 69	

Exercise 14

Drill 1	Drill 2	Drill 3
1. 14	1. 14	1. 16
2. 16	2. 16	2. 15
3. 10	3. 9	3. 13
4. 18	4. 16	4. 16
5. 14	5. 14	5. 14
6. 9	6. 12	6. 9
7. 15	7. 16	7. 11
8. 13	8. 18	8. 14
9. 16	9. 15	9. 16
10. 19	10. 21	10. 11
11. 14	11. 14	11. 15
12. 18	12. 17	12. 26

Exercise 15

See answers on pages 44 and 45

ANSWERS

Exercise 10

Item No.	Answer	Explanation
1	A	Oil is used to reduce friction between moving metal parts in most machinery.
2	B	Many gases may be used in welding, but acetylene gas is the most common one. It heats and burns the metal.
3	E	A piston is said to "freeze" when it sticks inside the engine block. This is usually caused by overheating.
4	D	"D" cells are dry cell storage batteries usually used in flashlights.
5	E	The head gasket is used to seal the cylinder head to the cylinder block. When the head gasket is blown a leak has developed through it, reducing the pressure in the cylinder.
6	B	A ball peen hammer is flat on one side and ball-shaped on the other.
7	D	An electrical circuit is often grounded so the current can flow into the ground.
8	A	A television set has an amplifier to strengthen the incoming signal waves.
9	A	All magnets have two poles. One end is the positive pole and the other end is the negative pole.
10	D	A Phillips-head screw has an X-shaped slot in its head.
11	A	In an automobile engine the gas mixture goes in the intake manifold and burned gases go out the exhaust manifold.
12	E	Current flow is measured in amperes. One ampere is the current flow produced by one volt acting through a resistance of one ohm.

Item No.	Answer	Explanation
13	E	Like a fuse, a circuit breaker protects an electric circuit when overloading occurs, thus avoiding damage to the circuit.
14	B	The regular brakes in an automobile are usually controlled by a hydraulic system which uses hydraulic fluid.
15	C	DC stands for direct current. The other kind of current is AC or alternating current. A dry cell, or a storage battery, gives DC.
16	B	A diesel engine does not use gasoline, but uses less expensive fuels. A common diesel fuel is called "Number 2 fuel oil".
17	C	Flashlight cells, when new, usually provide about $1\frac{1}{2}$ volts - therefore, 5 cells would give $7\frac{1}{2}$ volts.
18	E	All of these substances are lubricants, each with its own special use.
19	C	Tungsten carbide is used in the manufacture of tools such as the tips of high-speed cutting bits.
20	D	An alloy is a mixture of two or more metals.
21	B	A ripsaw is a wood saw designed to cut wood easily along the grain.
22	E	One type of automobile transmission is called Hydramatic.
23	B	The armature is one of the major parts of an electric starter motor. The armature turns to start the engine.
24	C	The terminals of the battery are the points at which the wires connect to it to form an electric circuit.

ANSWERS

Exercise 12

Item No.	Answer	Explanation
1	A	A vise is used by a machinist or carpenter to clamp his materials and hold them steady while he works on them.
2	A	A block and tackle is used to increase the mechanical advantage when lifting or hauling things.
3	E	Brakes fade on fast stops because they heat up. When this happens some of the braking power is lost after the brakes are applied.
4	B	A voltmeter measures electricity. It measures the number of volts flowing in an electric circuit.
5	A	The filament is a part of all electric light bulbs. The filament is heated by the electricity until it is white hot, giving off light.
6	D	Cold chisels are designed to cut metal that has not been heated.
7	A	Refrigerators usually contain compressed gas in their cooling system.
8	C	A fulcrum is a fixed point of support for a lever.
9	C	The cams on the camshaft of an automobile engine cause the valves to open and close.
10	E	Airplanes have ailerons on their wings to make them tip or bank.
11	A	The cylinders are in the automobile engine block. Fuel ignites in the cylinders to drive the automobile.
12	D	A jigsaw is used to cut along curved and irregular lines. The blade of a jigsaw is very narrow and is moved up and down.
13	B	A transformer is used to raise or lower voltage.
14	A	Calipers are instruments with two legs used by machinists and carpenters to measure thickness or diameter. There are outside calipers and insider calipers.

Item No.	Answer	Explanation
15	B	The claws of the claw hammer are designed to pull nails.
16	C	Bolts have threads. Threads are usually measured by the number per inch.
17	D	Pressure joints between parts of mechanical equipment which must be taken apart for repair or cleaning are usually sealed with gaskets.
18	B	Solvents are used to clean paintbrushes.
19	A	A brace and bit is used in working with wood. The brace has movable jaws for holding bits of various diameters for cutting holes of different sizes.
20	E	Caulking compounds are used to fill cracks. Various things are used in these compounds, like white lead, tar, or putty.
21	B	Taps and dies go together because they are both used to cut threads. A tap cuts threads on the inside and a die cuts threads on the outside.
22	D	Most automobiles have their flywheel where the crankshaft connects with the clutch or automatic transmission.
23	C	A commutator is an important part of any electric generator which develops direct current.
24	E	Magnets are used in many places in electricity and electronics. The telephone, microphone, loud speaker, and generator all have either permanent magnets or electromagnets in them.

ANSWERS

Exercise 15

Item No.	Answer	Explanation
1	A	Rivets are usually made of metal. A rivet is put through a hole and then pounded down to form another head.
2	C	There are many types of wrenches. An open-end wrench is one of them.
3	C	Fuses are so made that they will burn out at a low current load. This avoids overloads on circuits.
4	B	A carburetor is used to mix gasoline and air. When too much gasoline gets into the carburetor it is said to be flooded.
5	B	Neon is a gas. It is used in long fluorescent lighting tubes and it glows when an electric current runs through it.
6	D	A carpenter's plane is used to smooth wood by shaving it.
7	B	The automobile generator produces electricity for the car's use. Some kinds of generators are called alternators.
8	D	A block and tackle consists of ropes or chains and pulleys.
9	B	Material is worked on while held in a vise.
10	A	A ratchet wrench can turn a bolt faster than does a regular wrench, if the wrench cannot be turned a full revolution at a time.
11	E	A transistor and a radio tube can do many of the same things.
12	D	A hacksaw is used to cut metal.

Item No.	Answer	Explanation
13	C	Acid is an important part of an automobile battery. It is mixed with water and other chemicals to make the electrolyte (the fluid inside the battery).
14	B	Protractors are used for drawing and measuring angles.
15	E	When a spark is produced by a short circuit, several kinds of waves are released. Heat, radio, television, and static are types of waves that can be produced by a spark.
16	A	Wrenches are used to tighten or loosen nuts and bolts. The longer the handle on the wrench, the greater the leverage.
17	A	A dovetail joint is a type of joint used in cabinet-making.
18	E	None of the things listed is hydraulic. All of them are used in electric circuits.
19	E	Generators may be turned by water power to produce electricity.
20	C	A Geiger counter is used to measure and detect radiation.
21	D	An auger is used by a carpenter to drill holes in wood.
22	C	Soldering is used to join pieces of metal together. Solder is a mixture of metals which is melted with a hot soldering iron and used like glue.
23	C	An exhaust manifold connects with each cylinder in an engine to lead the exhaust gases to the muffler and tailpipe.
24	E	A nut screws on a bolt.

This is an experimental booklet intended to help young people learn basic principles and concepts of mechanics and technology by means of a series of aptitude training exercises. The exercises are similar to aptitude tests except that an explanation is provided of the underlying principle governing a particular class of items, as well as the correct answer.

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